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THE ALFALFA THIRPS AND ITS EFFECT ON ALFALFA SEED PRODUCTION*

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The Province of Alberta has the largest consolidated acreage of alfalfa in Canada and is rapidly increasing this acreage as new irrigation projects are opened. In spite of this, very little alfalfa seed is grown and new plantings are dependent upon imported seed. Attempts to promote the growing of alfalfa seed as an industry have met with poor success thus far, owing largely to the fact that it has been almost impossible to raise a paying crop of seed. Some growers have succeeded in getting profitable yields, but these cases are not at all general.

There are several factors which govern the production of seed concerning which more study is needed. These are largely problems of culture and methods of tripping the blossoms and have little to do with this paper, which deals with the influence of thrips on seed production.

Reports of poor blossom production and the early dropping of blossoms where alfalfa has been left to produce seed, have often been accompanied by specimens of thrips.

The examination of a long series of thrips collected from alfalfa in Alberta shows that the most prevalent species is *Frankliniella occidentalis* Pergande. This species is often confused with, and is probably closely related to, *F. tritici*, which has been reported as being found on alfalfa, but has never been associated with any particular extensive damage. During the later part of the summer, another species, *Haplothrips statice* Hal., is present, but not in serious numbers.

Both *F. tritici* and *occidentalis* are reported in literature as being common flower-thrips infesting fruit blossoms, and as being injurious to strawberries. They have also been recorded from cotton, but not in injurious numbers. It is evident that the distribution is general over the entire North American continent, and it may be more of a pest than is generally supposed. Owing to their small size, thrips are not always recognized by the average farmer as a potential pest. At Lethbridge, Alberta, specimens of *F. occidentalis* have been taken from blossoms of all the common weeds and flowering plants.

In 1915, Borden, in the Journal of Economic Entomology, Vol. 8, page 354, reports having found *F. tritici* in alfalfa blossoms feeding on the young floral parts, and causing the blossoms to drop prematurely without setting seed. Essig, in Bulletin 2, of the California Horticultural Commission, lists alfalfa as one of the host plants of this species of thrips, but does not record any damage. Cooley, in the 18th Report of the State Entomologist of Montana (1920), reports an unidentified species of thrips as being so plentiful in the Yellowstone Valley that it destroyed the blossoms of alfalfa and caused a 75 per cent. loss of the

*—Contribution from the Division of Field Crop and Garden Insects, Entomological Branch, Dept. of Agric., Ottawa Ont.

honey crop. Mr. R. C. Treherne, Entomological Branch, Ottawa, has since identified these specimens as *Frankliniella occidentalis* Pergande.

The adult insect is very minute, about 1 mm. in length, dark brown in color, and difficult to find in the field. The handling of stalks and blossoms causes the insects to hide or drop to the ground, and only hurried glimpses of them are caught as they run across a leaf or flower petal. If stalks of alfalfa are shaken over the hand or a piece of white paper, the insects will drop thereon and in this way may be easily distinguished and their movements can be readily observed. When very plentiful hundreds of them may be shaken out of a single handful of alfalfa stalks.

The adult thrips emerge from hibernation at Lethbridge, Alberta, when the alfalfa is about six inches high, soon after the first week in May. None of the immature stages are found at this time, but towards the last week in May eggs can be located in the stems, leaves and stipules. At this time the adults have practically disappeared over the entire field.

The eggs are very minute, whitish, cylindrical, and slightly curved or kidney shaped. They are laid inside the plant tissues and as tiny translucent bodies can be readily seen in the leaves and stipules. It is more difficult to find them in the stems of the plant as they are almost completely buried. Within three to five days after the eggs are laid they begin to swell and change color. As the swelling increases the eggs are forced partly out of the tissues in which they were deposited, the color becomes more yellow and the red eyes of the larval thrips are clearly visible through the chorion.

The eggs hatch in from six to nine days, depending on the weather conditions. The minute young thrips are yellow with red eyes, and remain for the most part in such places as unopened buds or at the base of the corolla tube of an open flower. The larval period is very variable and adults begin to appear in from six days to two weeks. All succeeding generations are so intermingled as to be almost inseparable; adults of two generations being present at the same time during the greater part of the summer.

From the time the first eggs appear in May until the first adults are found in June between two and three weeks elapse, depending upon the climatic conditions. As the weather becomes warmer and more settled it is probable that a generation can be completed in less than two weeks. The number of generations per season would necessarily vary with the time interval elapsing between the last frost in the spring and the first frost in the fall. There has been an average of seven generations during the past two seasons.

The seed production in alfalfa is materially reduced by thrips in two ways. The most severe losses are caused by the great decrease in blossom production due to the thrips feeding on unopened buds, while lesser losses are caused by the thrips feeding on the ovaries of the opened flowers or on the young seed pods. Experiments have been conducted to determine as nearly as possible the amount of damage that was due directly to thrips, both in the reduction of blossoms, and in the loss of seed after the blossoms had opened.

The younger stages of thrips feed in very protected places, and above all seem to prefer the minute flower buds while the entire spikelet is inside the general bud sheath. This causes the buds to die, and when the sheath opens

the buds are white or "blasted." As growth continues the spikelet stem grows bearing the dead buds, which soon drop off, leaving a bare stalk. This is the most serious form of damage, and actual counts have shown that as the thrips increased in numbers, after the middle of June, the percentages of blasted buds increased until by August over 80 per cent. of the buds produced were blasted. Stalks of alfalfa confined in thrips-tight cages, with and without thrips, showed that the "blasting" of the buds only occurred when thrips were present. The same conclusions were reached after a series of observations carried over two years through a great number of fields containing all degrees of thrips infestation.



Fig. 1.—Alfalfa Stalks of the same age showing the effects of Thrips on blossom production. The stalk on the left is from "clipped" alfalfa, the one on the right from the unclipped plot. Note the "blasted" buds and bare flower stems.

After the buds have grown out of the sheath they are reasonably free from thrips damage until they begin to open. All stages of thrips may be found inside of the open blossoms, but the adults are generally the more numerous. The greatest damage at this time is caused by the thrips feeding on the ovaries of the flower. This may be extensive enough to destroy the entire flower or it may only destroy part of the ovaries, allowing the pod to continue development with a reduced number of seeds. Caged blossoms which were tripped artificially, but which contained thrips, were so badly injured in 1922 that only 60 per cent. set seed with an average of 3.4 seeds per pod, while thrips-free blossoms under the same conditions resulted in a 100 per cent. seed setting with an average of 6 seeds per pod.

The tendency of all stages of the insect to spend most of the time in some well protected place about the plant, reacts against the use of contact

dust and sprays as control measures. Experiments with the eggs show that they dry up within a few hours after the stem in which they have been deposited is cut. Since the eggs are deposited by the first generation adults at about the same time of year, and followed by the disappearance of the adult, cutting the alfalfa at this time was tried as a control measure.

Two years of experiments in early cutting or "clipping" as it is generally called, have given results which warrant this method being used in seed-producing areas. The following average results have been prepared from actual counts during the past two years. It might be stated that the general tripping of blossoms from natural causes during 1922 was much lower than in 1921, so that the seed crop was lower in spite of a greater blossom production.

	% Blossoms matured	Av. Seeds per pod	% shrivelled or deformed seed	No. of healthy seed per 100 blossoms
Uncut alfalfa	40.9	3	53	57.67
Cut alfalfa	73.6	4.2	14	265.84

This table shows that the clipping was responsible for producing over four times as much seed as was produced on the uncut alfalfa. In addition a light hay crop was secured which would average from 800 to 1,000 pounds per acre at a time when the hay supply on the ordinary farm is about exhausted.

Examination of the clipped field revealed very few thrips present before July 15, even though the clipping was done at the last of May, and despite the fact that the field was bordered on two sides by alfalfa which was not cut early. Both the uncut areas were heavily infested with thrips, but the prevailing winds blew over these fields from the clipped field, reducing any reinfestation from this source to a minimum. It was not until late in August that the infestation in the various areas was at all equal. This late in the season the buds cannot possibly mature seed so that any thrips injury would not affect the seed crop, as the ripening seed is too far advanced to be injured.

Frequent examination of the alfalfa after it is six inches high gives the best clue as to when to cut. A handful of alfalfa stalks should be gathered every two or three days and shaken over a piece of white paper. The thrips will be found to increase in numbers after they first appear, and then to suddenly drop off until there are only a very few to the handful of stems. This will usually happen towards the last week in May, and then the alfalfa should be cut as low as possible and used for hay. The subsequent growth with proper moisture conditions will be very rapid, and the majority of the buds which will have time to mature seed will grow out of the bud sheaths before the thrips are plentiful enough to cause any appreciable harm. In some of the alfalfa seed-producing sections of Montana, the farmers have stated that it is their practice to cut alfalfa grown for seed at the end of May. Their reason for this was that it seemed to cause a heavier blossom production and as a result the seed yield was much higher and of better quality.

Only one insect has been found associated with the thrips in alfalfa which might be parasitic. This is a very minute Chalcid which has been determined by Mr. R. B. Gahan, of the U. S. Bureau of Entomology as *Thripoctenus americanus* Gir.

There are two predators which are common. One of these is a small Anthocorid which is plentiful and has been observed in all stages feeding on thrips. It has been determined as *Triphleps tricolor* Wlsh. by C. H. Curran, of the Entomological Branch, Ottawa. The other predator is a large black and white thrips, almost twice as large as *F. occidentalis*. Mr. R. C. Treherne has determined this species as *Aeolothrips fasciatus* Linn, a species which is commonly predaceous on various stages of thrips, and upon minute insect eggs in general.

A NEW VARIETY OF MELANOPHILA DRUMMONDI KBY.
(BUPRESTIDAE, COLEOPTERA)

BY A. B. CHAMPLAIN AND J. N. KNULL,

Bureau of Plant Industry, Harrisburg, Pa.

During the summer of 1922, specimens of a bright green *Melanophila* were collected in Canada. The specimens were so strikingly different in habits and general appearance from the specimens of *Melanophila drummondi* Kby., which were taken in the same localities, and to which the species is most closely related, that the authors decided to give it a name.

Specimens were sent to Prof. H. C. Fall, who stated that he had two examples which were part of a series taken by the late Frederick Blanchard in the White Mountains of New Hampshire.

Melanophila drummondi var. *abies* n. var. Form and size of *Melanophila drummondi* Kby., bright green, more shining below than above. Head coarsely punctured, strigose on vertex. Prothorax wider than long, narrowed at apex and at base, sides slightly sinuate, disk convex, impressed each side, also a slight median impression, surface crenulate at the sides, transversely strigose in the middle, with an irregular smooth median callus, lateral margin obliterated in front, but well marked posteriorly. Elytra widest back of middle, sides arcuate from base to obtusely rounded apices, lateral margin faintly serrulate near the apices, surface granulate punctate, with three rather indistinct costae on each elytron, sparsely pubescent, three spots on each elytron arranged as in *M. drummondi* Kby. Abdomen sparsely punctate. Length 9.5 mm.

Male. Last abdominal segment broadly emarginate.

Female. Last abdominal segment rounded.

This variety is closely related to *M. drummondi* Kby., but can be separated from this species by the sculpture of the prothorax and by the color.

Described from a series of adults collected on the trunks of dying balsam (*Abies balsamea*) at Lake Opasatika, western Quebec, June 1 to June 3, and at Bathurst, New Brunswick, June 24 to July 20, by J. N. Knull. The species undoubtedly breeds in balsam.

Type. A male, No. 543, in the Canadian National Collection at Ottawa, paratypes in the same collection, in the collection of the Bureau of Plant Industry at Harrisburg, the U. S. National Museum, the collection of Prof. H. C. Fall, and the authors' collection.

AGRILUS BILINEATUS VAR. CARPINI, NEW NAME

I propose this name for the variety *azureus* described by me in Canadian Entomologist, Vol. 54, p. 84. According to Doctor Obenberger, the latter name was given to a South American species by Kerremans. J. N. Knull.

NEW LIFE HISTORIES, SPECIES AND VARIETIES IN
PAPAPEMA (LEPIDOPTERA) No. 22.

BY HENRY BIRD,

Rye, N. Y.

To the already rich aggregation of *Papaipema* species which flourish in the Chicago region of Illinois, another addition is to be recorded, and an interesting one, for its larva departs from the conventional type and affords a new outlook on the ontogeny of the group.

A commingling of the floral types of the Chicago Plain, those persistent prairie species that once must have largely dominated the state, together with those which prevail in similar latitude eastward, has been productive of a wide list of food plants eligible to these borers. Keen to take advantage of the opportunity, the coterie of local lepidopterists have rounded out a list of species quite in excess of that for any other locality in the country. *Cerina*, one of the old Grote species and originally described from Maine, occurs at Chicago, but here as elsewhere, the acquaintance with its larva suggested that the preferred foodplant for this species is likely yet an unsolved problem. A widespread floral survey for enlightenment in this direction resulted in an unexpected disclosure.

To the clever field work of Mr. Emil Beer the discovery and proving of this distinct species is due. Since 1917 he has yearly been striving to gain the familiarity whereby a convincing series might be forthcoming, for his associates and the writer included, considered his find to be merely an instance where a *necopina* larva had straggled to some other plant than its usually preferred *Helianthus*. During four years he received scant encouragement with his search for larvae, emphasizing the difficulty of running down one that works so astutely, as well as the handicap fire plays in their extermination. While the foodplant involved, *Lacinaria pycnostachya*, is one of the once common prairie species, it was not until 1922 that favorable stations were found where the larvae were working in numbers. Some of these forwarded to the writer, proved at once that a larva very different from any of the known congeners had thus come to notice, no matter how close its adult may simulate another.

As pupation occurs in the foodplant this extends the period for nearly a month when specimens may be secured, and ultimately an extensive series is reared. It develops that a white marked variation occurs along with the more prevalent concolorous form, similarly as with *nebris*, *nitela*, *frigida*, *thalictri* and others. Very generously, the material and notes have been handed to the writer for descriptive and comparative treatment. Justifiably, and because of other similar contributions on the part of Mr. Beer, it is fitting to dedicate this disclosure to him.

***Papaipema beeriana* sp. nov.**

Head smooth on frons, antenna simple in both sexes and not set in an encircling tuft of white scales; thoracic vestiture matches primaries, the abdominal matches secondaries; the thoracic crest conical or truncate, not spreading; abdominal crests inconspicuous. Primaries produced at apex, of an even shade of smoky brown thickly sprinkled with white-tipped, and less so with bronzy, scales, while outwardly past the postmedial line a dull purplish sheen appears.

The markings are nearly obsolete, the postmedial line alone vaguely discernible, curves outward past reniform, then oblique to inner margin; the reniform is usually indicated as a darker area because of the omission of white powderings; or, the grey scales may outline the reniform; or the usual central line may alone be dimly indicated by greyish scales. There are no white dots on the costal vein. Secondaries dark, of an even smoky brown. Fringes are concolorous and glistening. Underneath the wings are of similar tone, with the whitish powderings equally abundant on the secondaries.

Expanse, 36 to 41 mm.

The male genitalia is of the typical generic pattern; the spinulated, trigonate tip of clasp is prolonged in line of axis; the harpe is the usual stout, curved prong, toothed posteriorly, and matches *necopina* closely.

A male type (holotype) from an observed larva is in the collection of the author and a considerable series of paratypes have been mostly returned to Mr. Beer, who will distribute them to the U. S. Nat. Museum and other important collections.

Type locality: The immediate environs of Chicago, Ill.

Little variation occurs in a series of forty bred specimens, either in size or coloration, and doubtless the species will be found very generally through the main range of the foodplant which Britton and Brown give as: "On prairies, Indiana to Minnesota, Nebraska, Kentucky, Louisiana and Texas."

For the white spotted form, as suggestive of the foodplant, we propose the name

***Papaipema beeriana lacinariae* form nov.**

Similar to the typical form in every respect except that the stigmata stand out conspicuously marked in white. The round white orbicular and double spotted claviform are in linear alignment; the reniform is the usual collection of white spots surrounding a brown lunulate line, with the central outward spot distinctly yellow.

Expanse and other features the same as type form.

A male type (holotype) from an observed larva is with the author, and seven examples for Mr. Beer and others are labelled paratypes.

It would appear from these breedings that *lacinariae* may occur in a ratio of about 12 per cent. Its spots are similar to those of *nebris* which it resembles closely, though much darker.

Typical *beeriana* is similar to *necopina* and *aerata*, less so to *maritima*, *silphii*, *duplicata* or *nitela*. The variety *lacinariae* agrees in a way with *limpida* also, and it is possible the two may prove identical upon fuller information. Guenée described *limpida* as having white or whitish secondaries—the *Lacinaria* feeder has them smoky brown. With *aerata*, the term "whitish" applies. Hampson* puts *aerata* with *limpida*, retaining the Lyman name for the concolorous form, and with *limpida* types before him we trust to his verdict. Positively *beeriana* is distinct from *aerata*. If Hampson has erred and Guenée's *limpida* proves identical with *beeriana*, the latter term should be retained as representative of the concolorous form of *limpida*, in which case *aerata* Lyman would be of full specific rank.

*—Catalogue Lepidoptera Phalaenae Brit. Mus. Vol. IX, p. 85.

Two larval instars were under observation.

Penultimate stage: Larva is constricted with sutures pronounced, segments seem correspondingly shorter as compared with the average cylindrical type, with the last joint much and abruptly reduced. Head normal, full, rounded, suture inconspicuous, concolorous, shining brownish yellow, mouth parts and ocelli darkened; width 2.9 mm. Body shows skin of thoracic segments a little puckered as though not fully distended, the abdominal joints smooth and distended; color is a livid pink, lighter on thoracic joints where a whitish translucence shows at the sutures. This larva is unique in that there is no trace of the usual longitudinal lines, though it is possible they may show at an early stage. Cervical shield as wide as head, of similar shining texture, laterally edged with a brown marking. The tubercles stand out strongly like minute blackish beads, in full complement, as, ventrally on joint five, VII has two minute plates confluent which bear setae, also a third bearing a hair, slightly removed. Few of the congeners exhibit such detail. The unstable character of IV on joint ten is evidenced in the inflate at hand which shows this plate above on one side, and below the line of the spiracle, on the other side of the body. Anal joint much reduced, with roughened blackish plate. Length 30 mm.

Mature Larva: Generally similar but color paler; a robust larva recalling the European *Xanthoecia flavago*, rather than cylindrical *Papaipema*. Head darker; width 3.1 mm. Shield with side marking lost; tubercles much paler and apparently reduced; on joint five VII and its associates are reduced to mere points but all bear minute setae, half the length of the seta on VI. On joint ten, IV is below the spiracle, the latter in all instances black and are exceeded in size slightly by the principal tubercle plates. Length 42 mm.

Maturity is reached July 25 to Aug. 10, and there is the usual prepupal period of quiescence of about a week.

The pupa is the normal type; rather robust, for there is ample space in its cell-like burrow. The position of the tubercles can be discerned on most of the abdominal segments. The variety *lacinariae* can be foretold as the white stigmata show plainly when the moth is near emergence. The cremaster is two stout spines, slightly diverging. Length 24 to 26 mm.; width 7 mm. Emergence September 3 to 27.

Parasitism in 1922 seemed slight, *Amblyteles laetus* (Brulle) being parasitic in the pupal stage, as it is with a majority of the species which pupate in their burrows. *Laetus* emerges from *Papaipema* hosts during September and these adults hibernate and presumably have an alternative host in the early part of the following season.

The life cycle for *beeriana*, so far as observed, accords fully with the congeners. The egg unquestionably carries over winter, and emergence is, as with the allies, in the last week of May, for the earlier examples. In 1921, Mr. Beer became doubly satisfied of the individuality of his discovery as then the appearance of the *lacinariae* variety dispelled all question of *necopina* relationship, and the assistance of Mr. A. K. Wyatt in 1922, helped in a final round-up of numbers. Their notes and observations deal with the larval period from June 11 onward: "The larva are hard to locate after having worked down to the root, no frass appearing, and the plant does not show evidence by wilting. An

irregular hollow is made in the root and much of the frass is left therein, making it very unclean when moist. One root clump may harbor several individuals, five pupae occurring in one instance in an isolated case. Where the plant was numerous, by using a spade, twenty-one pupae were found in an hour. On September 17, 1922, in getting twenty-two pupae at another station, many were noted to have already emerged."

The larval habit is similar to *P. duplicata* in that a cell-like chamber is formed under the epidermis of the bulky, leathery root, and there is the same inactive or lethargic attitude whereby a larva clings to its habitation even though partly demolished, or shows little inclination to move. *Lacinaria pycnostachya* differs from its eastern allies in having a sturdy root-system suitable for withstanding the vicissitudes of a prairie habitat. It was doubtless very abundant before the primitive prairie was disturbed, and from what we see of *beeriana*, the moth likely occurred in greater numbers in those times. That it keeps to its particular foodplant seems probable, for the extensive work done locally among these borers, has not revealed it from other plants. It is worthy of note that *necopina* has been reared from this plant, but it was identified as such even in the larval form from the dorsal stripe and other characters.

In demonstrating again how close the moths of this genus may come superficially, Mr. Beer's discovery is a fitting reward of persistent research.

ZARRHIPIS LE CONTE (COLEOPTERA)

BY H. C. FALL,

Tyngsboro, Mass.

The members of this genus take the place on the Pacific Coast of the *Phengodes* of the Atlantic region. Their rather large size, contrasting colors, and the beautifully plumose antennae of the males render them very conspicuous insects, and their scarcity is great enough to make them highly prized by all coleopterists. The females are, I believe, larviform, and are still rarer in collections.

Twenty years ago and more, in the days when the little work room of Chas. Fuchs on Kearney street, San Francisco, was the rendezvous of all resident and visiting coleopterists, some one one day brought in a jar of earth containing one or more of the big, luminous larvae (or females) of what we took to be a species of *Zarrhipis*, but whether the actual identity of these was ever established, I do not now recall.

For nearly thirty years there has stood in my cabinet a very distinct undescribed species of *Zarrhipis*, taken while on a collecting trip to the western borders of the Colorado Desert. It is high time this rarity was given a name.

When Horn described *Z. riversi* in 1885 he remarked that the superficial characters separating the four species which he tabulated seemed very constant. Assuming that he was correct, there are in my collection several other forms equally deserving of specific names. It is quite possible that increased experience, aided by breeding from the egg, if that ever shall become possible, will ultimately change our conception as to what constitute specific characters in this genus, but that is a problem for the future.

Z. truncaticeps new species

Head and elytra piceous black, sides of metasternum and last two abdom-

(segments black. Last joint of maxillary palpi piceous, elongate triangular, twice as long as wide, the apical edge shorter than the inner. Prothorax about inal segments dusky; palpi, base of antennae, thorax, body beneath and legs, yellow. Terminal joint of maxillary palpi slender, the apical edge only slightly oblique. Eyes very large and prominent; head abruptly constricted behind the eyes. Epistoma declivous and subcontinuous with the labrum. Prothorax nearly two-thirds as long as wide, sides moderately reflexed, surface almost absolutely smooth, not pubescent in the type. Elytra four times as long as the thorax, dehiscent, feebly, finely punctate, smoother than usual in the genus. Third tarsal joint not distinctly lobed. Length to tip of elytra (head and thorax deflexed) 11 mm.

Palm Springs, California, April 11, 1893.

By its abruptly constricted head, virtually non-lobed third tarsal joint, and distinctly dehiscent elytra, this species leans palpably toward *Phengodes*; the head, however, is not deeply excavated, and the elytra, though shorter and more divergent than in the other species of *Zarrhipis*, are much less so than in *Phengodes*.

Z. amictus new species

Rufotestaceous; antennae, except at base, and elytra, black. Last joint of maxillary palpi not very slender, the apex strongly oblique and nearly equal in length to the inner side. Eyes rather less prominent than usual, their longest diameter much less than half the width of the front. Head distinctly punctate; prothorax three-fifths as long as wide, sides rather narrowly margined, surface finely but quite evidently punctulate. Elytra somewhat crumpled but apparently of about the usual length, moderately scabrous. Length 10 mm.

California, Butte Co. Collected by F. W. Nunenmacher.

The characteristic features of this species are the comparatively stout terminal joint of the maxillary palpi, relatively small eyes, more distinctly punctate head and thorax, and the entirely yellow abdomen, agreeing in this last respect only with *integripennis*; the latter a larger species with more transverse and much more widely margined thorax, and more slender piceous terminal joint of palpi, the head also more rapidly narrowed to the neck.

Z. brevicollis new species

Rufotestaceous, antennae except at base, head, and last two abdominal segments, black. Antennal joints more slender, the rami conspicuously longer than in the preceding species. Last joint of maxillary palpi slender, fully three times as long as wide. Eyes very prominent; head rapidly obliquely narrowed to the neck. Prothorax twice as wide as long, very broadly margined and very minutely remotely punctulate. Elytra six times as long as the prothorax, finely punctate, and feebly scabrous. Length 12.5 to 16 mm. to the elytral apex.

The type of this species was taken at Loma Linda, Southern California. March 17, by G. H. Pilate. Other examples are from Claremont (Baker) and San Diego (Ricksecker). Two others, from Pasadena and Redondo differ in having the head rufotestaceous like the thorax, but seem otherwise identical.

Z. alamedae new species

Rufotestaceous; antennae except at base, and seventh and eighth abdominal

four-sevenths as long as wide, sides moderately margined. Elytra about four and one-half times as long as the thorax, more strongly scabrous than in any of the preceding species. Length (to elytral apex) 9.5 to 12 mm.

Alameda Co., California. Two examples; a third in the collection of Mr. C. A. Frost.

This species is probably most closely related to *riveri*, the type of which I have not seen. The chief distinguishing characters of the latter as given in the following table are taken from Horn's description.

TABLE OF SPECIES.

1. Head behind the eyes abruptly transversely constricted; third joint of tarsi not distinctly lobed; epistoma declivous, scarcely elevated above the labrum *truncaticeps*.
Head behind the eyes more or less obliquely narrowed to the neck; third and fourth joints of tarsi lobed beneath; epistoma elevated above the labrum 2.
2. Body beneath entirely flavo- or rufotestaceous 3.
Body beneath rufous, seventh and eighth abdominal segments black or piceous 4.
Body beneath, except of prothorax, black or piceous 5.
3. Apical edge of last joint of maxillary palpi not very strongly oblique and much shorter than the inner edge; prothorax shorter and more widely margined *integripennis*.
Apical edge of last joint of maxillary palpi strongly oblique and subequal in length to the inner side; eyes smaller *amictus*.
4. Head typically entirely or in great part black (see remarks under description of *brevicollis*); maxillary palpi entirely yellow, terminal joint as long as the preceding, only slightly dilated apically, the apex feebly oblique *brevicollis*.
Head piceous, middle of the front and the clypeus reddish yellow; terminal joint of maxillary palpi piceous, triangular and shorter than the preceding joint *riveri*.
Head rufotestaceous, terminal joint of maxillary palpi piceous, fully as long as the preceding joint, apical edge shorter than the inner .. *alamedae*.
5. Head, palpi and legs black or piceous; thorax very broadly margined; size large (13.5 mm.) *ruficollis*.
Head pale in front, palpi except terminal joint, and legs, pale; thorax narrowly margined; size much smaller (10 mm.) *piceiventris*.

In Horn's table and remarks on this genus (Trans. Am. Ent. Soc. XII, 1885, p. 148) there are two errors of statement. The palpi in *piceiventris* are there said to be entirely piceous; they are in reality yellow with the last joint piceous. Moreover, the body beneath in *ruficollis* is as given in the table above, not rufous with tip of abdomen black, as stated by Horn.

Of all the species, the elytra are smoothest in *integripennis*, and are perhaps most strongly rugose or scabrous in *ruficollis*, though *piceiventris*, *alamedae* and probably *riveri*, have the elytra nearly as rough. *Ruficollis* is most robust, the sides of the thorax broadly and steeply reflexed, the antennae blacker than

usual, the erect hairs of the antennal rami in most species being brownish fuscous; it is the only species with dark legs.

Riversi is known to me only from the description. There is a specimen bearing this name in the Le Conte collection, but as it does not agree in several particulars with Horn's diagnosis, I do not at present accept it as an exponent of the species.

In a considerable number of specimens examined the penis is more or less exposed. This organ is in all cases very slender and subcylindrical, feebly and gradually dilated apically, the dilated portion absolutely simple in *integripennis* and *piciventris*; excavated on one face (spatuliform) in *alamedae* and *brevicollis*, more feebly so in *truncaticeps* and in the specimen labeled *riversi* in the Le Conte Collection; not visible in *ruficollis* or *amictus*. Whether these differences will prove constant and characteristic it is not as yet possible to say.

Color characters have been used freely in the table because so easily apprehended; they have not, however, been relied upon solely in any single instance. I suspect that the infuscation of the head and abdominal apex, as well as of the terminal joint of the maxillary palpus will prove more or less inconstant, but even here it is impossible to speak with much assurance without a larger series of specimens than I at present command.

The types of the new species herein described are in the writer's collection.

FRAGMENTARY NOTES ON FOREST COLEOPTERA

BY A. B. CHAMPLAIN AND J. N. KNULL,

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In a previous article¹, the authors presented notes on Coleoptera from rearings, field observations and collections, which were additions to the knowledge of certain species. The following collections of fragmentary notes of a similar nature from further rearings and observations were made by the authors, or by others to whom due credit is given, and are published with the permission of Prof. J. G. Sanders, Director of the Pennsylvania Bureau of Plant Industry.

LYMEXYLIDAE

Melittoma sericeum Harris. Apparent damage to chestnut beams supporting heavy articles in a storage house on the Mt. Gretna State Military Reservation was brought to the attention of Prof. J. G. Sanders. The writers, acting for the Bureau, visited the Reservation, and found that the timbers, cut from local woodlots, were heavily infested with this "Chestnut timber worm." Quantities of frass in small piles throughout the building caused by the continued working of the larvae of *Melittoma* in the beams made a problem that loomed large to the authorities. Our idea that the natural drying out of the timbers would cause the *Melittoma* larvae to die was borne out by subsequent observation. Samples taken into the laboratory quickly reacted to the dry conditions; for a short time dust piles were observed, soon they ceased altogether. Later report from the commandant at the military reservation corroborated our observation that no serious damage was done.

1—Miscellaneous Notes on Coleoptera, The Canadian Entomologist, Vol. LIV, p. 102. (1922).

OSTOMIDAE

(Temnochilidae, Trogositidae)

This family of beetles approaches the Cleridae² in their importance as beneficial insects. Especially the genus *Temnochila* (*Trogosita*), which is prevalent wherever *Dendroctonus* occurs. They are predaceous in both larval and adult stages. The larvae are able to enter the mines and galleries of destructive bark-beetles and feed upon the broods, including eggs, larvae, pupae and even newly transformed adults. Upon eradicating the brood of one parent they migrate to another gallery.

The adult Ostomids prey upon small insects that may be found on the outer bark and beneath the bark of trees that are or have been infested by bark-beetles.

Although they are not as active as adult Clerids and their activities are principally confined to their dark habitats, they may be found flying on warm, sunny days; at night the adults may be found on the outer bark of bark-beetle infested trees, mating, feeding or ovipositing.

Corticotomus caviceps (Fall). A common predator on the larvae of pin-hole borers and Calandrid beetles of the genera *Cossonus* and *Rhyncholus*. The adults of *C. caviceps* may be found in the galleries or mines of the pin-hole borers and Calandrids; their elongate, cylindrical form being especially adapted to these conditions. They hibernate as adults and may be found in this stage throughout the winter months, in pin-holes, beneath and inside the bark, near the base of dead conifers. In captivity the adults feed readily on Scolytid and other small larvae, and it is probable that the larvae of *C. caviceps* prey mainly upon the larvae of Calandrids, pin-hole borers and Scolytids. Colorado and Western U. S.

Corticotomus cylindricus (Lec.) Harrisburg, Pa. Reared from *Rhus toxicodendron* infested by Scolytids, H. B. Kirk, Wildwood Park, Harrisburg, Pa., April 27; adults found in mines and galleries of *Phthorophloeus frontalis* (Oliv.) in mulberry bark. Miami, Florida, April 14, adults taken in umbrella while beating pine.

Airora teres (Melsh.) Colorado. Comparatively rare, predaceous on Scolytids in conifers.

Airora cylindrica (Serv.) Harrisburg, Pa. Adults collected at night on hickory trees infested with *Scolytus quadrispinosus* Say; Kirk and Champlain.

Temnochila (*Trogosita*) *aerca* (Lec.) Arizona. A large species that is primarily a predator on borers in deciduous trees and plants. The larvae mining through the galleries and burrows of wood-borers.

Temnochila virescens (Fab.) Pennsylvania and Eastern United States. A predator on wood and bark-borers in coniferous trees, more especially Pinus. The adults prey upon small insects that occur on and beneath the bark, while the larvae enter the mines and galleries of wood and bark borers and feed upon the broods, eggs, pupae and newly transformed adults.

Temnochila virescens var. *chlorodia* (Mann). One of the most important predators on forest insects in the west. It is found wherever *Dendroctonus* occurs, the parent placing eggs in a tree during or soon after an attack by *Den-*

2—Larvae of North American Beetles of the Family Cleridae, by A. G. Boving and A. B. Champlain, Proc. U. S. Nat. Museum, Vol. 57, No. 2323.

droctonus. In Colorado during June and July the newly hatched larvae of *T. chlorodia* enter the galleries and mines and consume both eggs and larvae of bark-beetles. These predaceous larvae migrate from one brood to another in their search for food and continue to attack the *Dendroctonus* broods until the latter transform and emerge. It is possible according to observations that we have made that this insect requires several years to reach maturity, spending the second year of its larval existence in the *Dendroctonus* abandoned tree, feeding on the larvae of secondary wood borers.

The mature or prepupal larvae are found in cells in or beneath the bark, usually near the base of the tree. Here they often overwinter in a curled position. Specimens collected in this condition readily pupated indoors and transformed to adults.

Tenebrioides. There are a number of species in this genus that occur as predators on forest insects. In both deciduous and coniferous trees both larvae and adults may be found feeding on the larvae of wood and bark-borers; on the whole they are decidedly beneficial.

Tenebrioides bimaculatus (Melsh.) Pa., N. Y. Adults reared from larvae taken from mines and pupal cells of *Agrilus bilineatus* Web., in the outer bark of oak. The larvae were curled up in the cells with the remains of the *Agrilus* larvae.

Ostoma quadrilincata Melsh. Inglenook, Pa., May 17. Adults found in pupal cells of *Bellamira scolaris* Say in dead decaying *Betula nigra*. One adult to a cell.

Thymalus marginicollis Chev. Harrisburg, Pa. Adults reared from larvae found in dead, soft willow limbs.

TENEBRIONIDAE

Hypophloeus. It has been the experience of the writers to find these beetles in trees that have been killed by bark-beetles. They are apparently not predaceous but rather are scavengers feeding on refuse in the bark-beetle galleries, mold and fungous growth.

Hypophloeus parallelus Melsh. Overwinters in the adult stage, beneath the bark and in old bark-beetle galleries and mines in coniferous trees. They may be found in small groups, apparently living in harmony with other hibernating species such as adults of *Aulonium longum* Lec., *Corticotomus caviceps* Fall, small Histerids, Staphylinids, Ips, etc. It is commonly found in trees from which bark-beetles have emerged from one to two years before, but is present in bark-beetle infested trees to some extent. The larvae are to be found in the same situation as the adults and are found during the summer months.

Our specimens are from Colorado, New Jersey and Pennsylvania. The eastern specimens are generally smaller and less robust, and may be different, although no characters were found on which to base this supposition. The eastern specimens were usually found in small numbers, often but one at a time, and are somewhat rare.

Hypophloeus cavus Lec. Occurs beneath the bark and in the galleries and mines of *Scolytus quadrispinosus* Say in hickory. The adults are active at night, running over the bark of trees that are attacked by *Scolytus* and also

those that have been abandoned by the bark-beetles. It undoubtedly acts as a scavenger in these situations. It is not rare at Harrisburg, Pa.

Hypophloeus tenuis Lec. Specimens from Ambler, Pa., May 11, and Monroe County, July 22. In both instances the adults were taken from the galleries of *Pityogenes hopkinsi* Swaine, in cut white pine branches.

ANOBIIDAE

Habrobregmus carinatus (Say). Det. H. C. Fall. Pittston, Pa., June 5, 1922. Sent in to the Bureau by correspondent who states that they were breeding in and damaging timbers in his cellar.

Petalium bistriatum Say. Det. H. C. Fall. Harrisburg, Pa. Reared from dead sumac.

BOSTRICHIDAE

Scobicia bidentata (Horn). Inglenook, Pa. Breeds in dry, dead sassafras. Infests trees several inches in diameter that were attacked and killed by *Apteromechus ferratus* (Say). The saplings and seedlings are attacked after being killed by the work of *Oberea ruficollis* Fab. in the roots.

Dinoderus brevis (Horn). Det. H. C. Fall. Harrisburg, Pa. Breeding in a fancy workbasket made of bamboo (?) or reed. A cosmopolitan species.

MYLABRIDAE

(Bruchidae)

Mylabris mimus Say. Hummelstown, Pa. Adults and pupae found in the seed of *Cercis canadensis*, December 17th. The larvae pupate in the fall and transform to the adult stage through the fall and winter. A few exit holes indicate that adults had emerged in the late fall.

Mylabris bivulnerratus Horn. Camp Hill, Pa. Collected and reared from the seed of *Cassia medsegeri* by Salome Comstock of the Bureau of Plant Industry. It is recorded in the literature as breeding in the seeds of a related plant, *Cassia marilandica* L.

PLATYSTOMIDAE

Gonotropis gibbosus Lec. Inglenook, Pa., June 27, July 24. Adults collected on dead hemlock branch during successive years. Aylmer, Que., Aug. 12, adult collected.

Tropideres bimaculatus (Oliv.). Hummelstown, Pa., May 20. Adult collected resting on dead white oak.

CURCULIONIDAE

Otidocephalus scrobicollis Boh. Hummelstown, Pa., Feb. 26, 1922. Pupae and adults found in fallen dead branches of *Quercus alba*. The larvae had worked through the central part of the dead twigs. Adults occur during May.

Cryptorhynchus obtentus Herbst. Reared from dead, down, decaying limbs of *Betula lenta* from four different localities in the vicinity of Harrisburg, Pa. Adults collected June and July.

STUDIES IN CANADIAN DIPTERA

I. REVISION OF THE ASILID GENUS CYRTOPOGON AND ALLIED GENERA.

BY C. HOWARD CURRAN,

Ottawa, Ont.

(continued from page 95)

Eucyrtopogon comantis new species

Dorsum of thorax with conspicuous white mane anteriorly; arista about two-thirds as long as third antennal segment.

Length 11-12 mm. *Male*. Face moderately convex, thickly covered with white pollen, mystax chiefly black, but the silvery white hairs numerous so that it appears chiefly white except in the middle and below; front opaque black, the orbits thinly silvery pollinose; pile luteous, on the ocellar swelling black, tipped with white. Occiput with white pile, the occipital ciliae luteous, the pile in their vicinity more or less so; cheeks with black pile tipped with white. Antennae black, with a whitish bloom, more yellowish on the first two segments, the pile pallidly luteous, one or two long hairs below the second segment, brownish; third segment narrow, gradually tapering, the immediate base swollen; arista slender, its basal segment thicker than the median, short, the apical segment spinose.

Thorax with the ground color shining black; a broad, geminate, complete median longitudinal stripe, blackish, the median whitish line not always distinct; on either side and above the roots of the wing a whitish vittae; elsewhere on the dorsum and on the pleurae more or less thickly covered with olivaceous yellow or golden brownish pollen. On the middle line a conspicuous white mane on the anterior half, bordered laterally by long black hairs; long white hairs just before the scutellum, elsewhere on the dorsum, black, the bristles brownish, tipped with white; on the pleura white, on the epimeron luteous yellow, the hairs below white. Scutellum convex, thinly, velvety brownish yellow, with abundant fine white pile; bristles long, slender, black, becoming yellow, the ends silvery white.

Legs black, the tibiae chestnut, pile chiefly yellow on the base of the hairs, the ends silvery white, so that it appears mixed yellowish and white; bristles piceous or piceous reddish. Anterior tibiae internally, the posterior ones intero-posteriorly and their tarsal cushions bright brownish red.

Wings chiefly hyaline, the apical portion greyish villous; crossveins and bifurcation of third vein and furcation of fourth and fifth veins clouded with brown; costa with double row of abundant curved spinulose hairs.

Abdomen shining greenish black; on the disc with short yellow, laterally with rather abundant, fine white pile, the bases of the hairs rather tawny, so that the pile appears intermixed; on the basal two segments mostly white; on the sixth ventral segment dense, sharply limited apically, reddish or tawny basally, the ends of the hairs white, but some black hairs intermixed. On the sides of the first to sixth segments apically a small, sub-oval greyish sericeous spot.

Holotype—♂, Chilcotin, B. C., April 29, 1920, (E. R. Buckell); No. 565, in the Canadian National Collection, Ottawa.

Paratypes—♂, Vernon, B. C., Oct. 13, 1918, ♂, Vernon, B. C., Dec. 1, 1918, both collected by E. R. Buckell.

***Eucyrtopogon albibarbus* new species**

Mystax and beard mostly whitish; thorax with a sub-median row of piceous bristles, within which the pile is white on anterior half; abdomen with seven pairs of greyish sericeous spots.

Length 10 mm. ♀. Face gently convex; evenly covered with greyish sericeous tomentum; pile, when viewed from above, almost all whitish, the bases of the hairs above the oral opening brown and tawny. Front sub-shining black, with some yellowish tomentum, condensed along the orbits. Pile yellowish, the long hairs brownish basally. Antennae black, the two first segments with thin yellowish bloom; third segment moderately narrow, evenly tapering to its apex; style slender, not quite as long as the third segment.

Thorax covered with tawny tomentum, the usual geminate stripes and spots brownish. Pile brown, tipped with white, a row of long bristles outside the geminate stripe, between which, on the anterior half, the pile is white. Pleura with pallid yellowish pile. Scutellum convex, with tawny bloom in some lights; pile white; bristles slender, brownish, their bases yellow.

Legs black; pile whitish, not very abundant, bristles yellowish, anterior inner surface of front and posterior inner surface of hind tibiae with tawny pile, that on the front ones paler. Hind coxae simple.

Wings hyaline, not at all villous, the crossveins and furcations with small clouds of luteous brownish.

Abdomen shining greenish black, slightly metallic, each segment on the posterior angles with a greyish sericeous spot, those on the fourth to sixth segments reaching forward to the anterior margins along the sides. (The abdomen has been wet, so that it is not possible to determine definitely whether the spot on the third segment reaches completely forward.) Pile pallidly yellow, longer laterally, not abundant.

Holotype—♀, Moose Jaw, Sask., (Geo. S. Johnston); No. 564, in the Canadian National Collection, Ottawa.

This species is most nearly related to *E. comantis*, but seems to be quite distinct. The absence of villi on the wings will distinguish it from any species known to me. The small spots on the wings are very similar to those found in *Comantella maculosus*.

***Eucyrtopogon spinigera* new species**

Closely related to *E. diversipilosis*, but the ♀ genitalia bears 12 spines; the dorsum of the thorax with a complete white pilose border, the spines of the scutellum almost all white, their bases narrowly yellow.

Length 10.5 mm. *Female*. Face moderately convex; with greyish white tomentum except an oval brownish spot on each side above; pile black, tipped with white. Front with brownish tomentum greyish along the orbits, pile black and luteous intermixed, the hairs on the ocellar swelling tipped with yellow. Occiput white pilose, the ciliae piceous except apically. Antennae black, the first two segments with greyish yellowish bloom, and yellow hairs, one long, blackish hair beneath the second segment; third segment moderate in width, gradually tapering; arista about two-thirds as long as the third segment, moderately slender.

Thorax with tawny bloom; the geminate stripe sub-shining blackish brown, the median stripe rather wide, greyish yellow, a short stripe on either side behind the suture and a broader one before the scutellum shining blackish brown; an oval spot before the suture, a more roundish one behind and an elongate apical triangle, rusty brown; bordering all the brown spots the tomentum is silvery whitish in some reflections; on the pleura, except the mesopleura greyish white tomentose. Pile of the dorsum black, the margins and pleura with yellowish pile. Scutellum convex, yellow tomentose in some lights, white pilose and spinose, the spines yellow basally.

Legs black, tibiae reddish chestnut. Pile and bristles luteous, tipped with white, appearing chiefly whitish on anterior legs. Coxae simple.

Wings largely cinereous villous, the crossveins and furcations crowded with yellow brown.

Abdomen shining greenish black, with short, yellow hair on the disc, longer, yellow, but not abundant on the sides. On the posterior angles of each segment with a greyish white pruinose spot, all the spots wider laterally, that on the sixth segment reaching almost to the anterior margin on the side. Venter greyish yellow pollinose, with yellow pile, the last segment with black pile.

Holotype—♀, Victoria, British Columbia, May 16, 1916, (R. C. Treharne); No. 563, in the Canadian National Collection, Ottawa.

***Eucyrtopogon diversipilosus* new species**

Allied to *nebulo*, but a little smaller and with less hairy abdomen, hoary pollen along the sides of the front. The lower fringe of curved hairs are shorter than the width of the costal cell, as in *nebulo*.

Length 9 mm. *Male*. Face a little convex, strongly convex retreating below, silvery white pollinose, with a brownish spot on either side above. Mystax black, the hairs tipped with white. Front yellow-brown pollinose in the middle, more or less broadly whitish pollinose on the sides. Pile of front entirely black. Antennae black, silvery in some lights, with white hairs, but usually two or three black ones on the second joint; first joint longer than the second; third one and one-quarter times as long as first two, style equal to length of first two, rather slender. Occiput wholly fine white haired and whitish pollinose.

Thorax shining black, more or less thickly tawny brownish pollinose; in the middle with a complete white longitudinal line, which is a little widened anteriorly and expanded just before the scutellum; on either side a broader, abbreviated stripe, interrupted before the suture, the spot formed by the front section triangular, postalar calli above and below, the lateral margins, humeri and a broad longitudinal stripe on the middle of the pleura, white. On either side of the median white stripe is a broad, subopaque black stripe. Pile of the dorsum black, sometimes a few white hairs on the middle line in front and on the postalar calli; pile of pleura almost all pale; there may be a few brown or black hairs on the mesopleura and some of the trichostical hairs may be black, but they are chiefly pale, although often have a reddish tinge. Scutellum with a whitish bloom, and fine white hair; with eight or ten slender apical whitish to brown bristles.

Legs wholly black, with white pile; the bristles slender, usually brown or blackish, but many pale. The pile is long but not very abundant, so that

the ground color is not obscured. Front tibiae slightly curved, the others straight. Inner anterior side of front tibiae and inner posterior side of the hind ones rusty reddish and the tarsal pads, rusty yellowish pubescent. Hind coxae not with distinct tubercle but with small projection.

Wings yellowish on posterior basal half; the apical half grey, with a broad, interrupted fascia behind the apex of the first vein, a small spot on the third vein midway between the crossvein and furcation and a transverse spot beyond the furcation, mostly situated behind the third vein, hyaline; all the crossveins and furcations bear brown spots, the first series forming an abbreviated, rather broad fascia about the middle of the wing. The curved hairs on the costa are decidedly shorter than the width of the costal cell.

Abdomen shining blue black, the sides of each segment with a posterior elongate oval sericeous spot. Pile short, sparse, tawny, on the dorsum; on the sides long, whitish basally, grading to brownish at apex. Last two ventral segments with dense, erect blackish or brown pile.

Female. Very similar, but less densely pilose. Mystax thinner and with some fine white hairs intermixed.

Thorax much more whitish, so that the brown pollen is left as large, isolated spots; one before and behind the suture; one just behind the humeri and another inside them contiguous with the black stripe, and another running to the postalar calli from the outer side of the one behind the suture. Humeri white pilose.

Wings much paler, not at all yellowish.

Pile of abdomen short, more sparse, all pale.

Holotype, ♂, Chilcotin, B. C., May 14, 1920, (E. R. Buckell), No. 561 in the Canadian National Collection, Ottawa.

Allotype, ♀, same data.

Paratypes, ♂, same data; ♂, same locality and collector, May 12; ♂, Banff, Alta., Sept. 20, 1922, (C. B. D. Garrett).

This species can generally be readily distinguished from *nebulo* by the wholly black tibiae, as in that species they have a reddish cast on the outside in the ♂. The ♀ is smaller, but less readily separated. Both these species are readily separated from ♂ *calcarata* by the shorter curved hairs on the costa.

***Eucyrtopogon calcarata* new species**

Curved bristles on costa almost all black; abdomen of ♂ with 7 pairs of greyish sericeous spots; anterior apex of posterior coxae produced forward into a tuberculate spur, only slightly so in the ♀; spots on sixth and seventh in ♀ occupying the whole length of the segments.

Length 10-11 mm. *Male.* Face and front sub-shining black, the former covered with greyish white, the latter with thin, brownish yellow tomentum. Pile black, on the occiput towards the neck and wholly on the lower half, white; tips of facial hairs cinereous. Antennae black, first two segments with thin, yellowish tomentum, third with cinereous bloom, about equal in length to the two first combined, evenly tapering from its rather broad base to slender apex; style about as long as third segment, slender.

Thorax shining black in ground color, covered with tawny tomentum or pollen, the median stripe, a spot on the humeri, one at the inner end of the suture

and an elongate one above the root of the wings silvery whitish; the geminate stripe shining blackish brown, abbreviated behind but connected with an elongate, more laterally placed spot before the scutellum; a roundish spot before the suture and an elongate, narrow one behind, shining; pleura with greyish white bloom, the mesopleura with tawny. Pile on dorsum black, on pleura luteous; a few brown hairs on the epimeron above. Scutellum convex, with tawny bloom in certain lights; pile white, bristles slender, brownish, their apices yellowish or whitish.

Legs shining blackish, pile tawny, the ends of the hairs broadly white; Bristles brownish basally. Hind coxae with the interior apex produced forward into a conical tubercle; a smaller tubercle on the trochanters between the coxae and femora, on the lower posterior side.

Wings mostly hyaline, cinereous villous apically, the crossveins and furcations clouded with brown. Lower row of curved hairs on the costa as long or slightly longer than the width of the costal cell.

Abdomen shining black, on the disc with rather short yellowish hairs; on the sides with long luteous pile almost white basally, on the apical segments subapically with some black hairs, extensive on the sixth segment. Last ventral segment with a tuft of brownish red pile apically. On either side with seven greyish, sericeous, elongate oval spots, that on the seventh segment occupying the whole length on the lateral fourth.

♀. Similar. The dark thoracal markings are brown instead of black, the abdominal spots are broadest laterally, those on the sixth and seventh segments occupying the full length of the segments laterally, those on the seventh small.

Holotype, ♂, Banff, Alta., October 27, 1917, (N. B. Sanson), No. 562, in the Canadian National Collection, Ottawa.

Allotype, ♀, April 25, 1917, (Sanson).

Paratypes, ♀, April 25, 1917, (Sanson); 3 ♀, Cranbrook, B. C., (C. B. D. Garrett); ♂ ♀, Nicola, B. C., June 1, 1922; ♀, Aspen Grove, B. C., June 15, 1922; ♀, Quilchena, B. C., May 21, 1921, (P. N. Vroom).

Distinguished by the spur on the hind coxae and the long, lower row of hairs on the costa.

***Eucyrtopogon nebulo* O. S.**

Front dull brown, the orbits more yellowish; abdomen of male with six pairs of isolated greyish white spots.

Length 10.5—11.5 mm. *Male*. Face moderately convex; covered with greyish white tomentum; a sub-oval reddish brown area on either side above the middle; pile black, the apices of the hairs brassy yellow. Front dull reddish brown, the orbits narrowly yellow pollinose; pile black, the hairs on the ocellar swelling tipped with yellow or white. Occipital ciliae black, their tips white, occiput with yellow pile above, white below. Antennae black, the first two segments with yellowish bloom; pile brownish and luteous, the one or two long hairs brown; third segment tapering, more strongly narrowed at the apical third; arista slender, about half as long as the third segment.

Dorsum of thorax with a posteriorly abbreviated geminate blackish brown longitudinal stripe, the median stripe greyish white with a yellowish tinge on

the disc; a narrow stripe on either side behind the suture, and a pair of posteriorly contiguous spots rising from the posterior margin, the inner one triangular, on the apical sixth, shining blackish brown, immediately before and behind the suture large oval brownish areas; a yellowish sericeous spot on the humeri, the inner end of the suture and on each side of the middle about the anterior third; elsewhere, the thorax is brownish red or tawny tomentose, on the pleura whitish or pale yellowish; on the middle line of the dorsum in front more or less white. Scutellum convex, apparently tawny tomentose, the pile rather long, white, the spines white but appearing more or less luteous or brownish.

Legs black, the tibiae chestnut brown except apically, and the immediate base; pile brownish red, the long hairs with whitish or yellowish apices; many of the long hairs blackish.

Wings hyaline on basal two-fifths, elsewhere smoky or luteous villous with numerous clear areas; brownish areas on the cross-veins and the bifurcations of the third vein.

Abdomen shining greenish black, with rather sparse, tawny hairs on the disc; on the sides with long, moderately abundant brown hairs, basally almost whitish; the apical ventral segment with a posteriorly sharply limited band of black hairs. On the sides of segments one to six posteriorly a sub-oval greyish sericeous spot, those on the third to fifth segments narrowed laterally, those on the sixth broadly separated from the lateral margin.

Female. Sublateral oval spots and stripes tawny in some lights, the tomentum generally more greyish, the sericeous areas more extensive. Pile on abdomen wholly paler, the spots all wider laterally, the seventh segment without spots.

♂, Royal Oak, B. C., April 19, 1917, (R. C. Treherne), ♀, Royal Oak, May 5, 1917, (Treherne); ♀, Duncan, B. C., June; ♂, no locality label, Oct. 7, 1904.

***Eucyrtopogon varipennis* Coquillett**

Wings with four elongate marks forming an irregular line and the costal border of the wing beyond the first longitudinal vein deep brown.

Length 9.5 mm. *Male.* Face only slightly swollen; whitish pollinose in some lights, with a rich, brownish spot above on either side; front with similar pollen, which is largely tawny toward the middle. Pile of face extending almost to antennae, the hairs all black, their tips white. Front and upper portion of occiput black haired, the hairs mostly with white tips; occiput elsewhere with fine whitish pile, the orbital border white pollinose. Antennae entirely black, more or less silvery dusted, the first two joints with black hair; first two joints of equal length, the third moderately longer than the first two combined; style almost as long as the third joint, rather slender.

Thorax shining black; covered with a cupreous brown pollen, which leaves a broad, geminate, median stripe and an interrupted one on either side, of the dorsum, shining; on either side of the geminate stripe is a silvery white stripe, which is interrupted behind the root of the wings, as stripe is oblique on its posterior portion, rising at the corners of the scutellum, crossing the

inner end of the postalar calli and not quite reaching the root of the wing. Pile of the dorsum nearly all black, as there are just a few pale hairs in the middle in front, and on the postalar calli. The longer hairs are not conspicuous and are mostly tipped with white. Pleura white haired; the mesopleura above and behind with black pile; trichostical pile fine, white, but not conspicuous owing to the strong black bristles. Scutellum tawny pollinose with long, rather wooly white pile; the longer apical hairs not conspicuous, whitish.

Legs entirely black; adorned with long and short black, tawny or brownish and white pile, which is especially long behind the front and middle tibiae, the middle tibiae bear on their outer side a row of six or seven black bristles which are tipped with white; the front and hind ones bear several apical bristles. The front tibiae are curved towards the front, the middle ones are curved anteriorly and outwardly, while the hind ones are straight, a little swollen apically and as long as their femora. The antero-interior surface of the front and hind tibiae is densely yellow pubescent. The posterior side of the front tarsi bears long, whitish or slightly yellowish hair, which is conspicuous but not very dense.

Wings greyish; yellowish behind the sixth vein and in the costal cell, with deep brown markings as follows: a pair of elongate, narrowly connected spots in the first basal cell, just before the middle; an elongate oval spot filling the submarginal and part of first submarginal cell just beyond the branching of $R_2 + 3$; an elongate spot on the anterior crossvein; and the costa broadly beyond the apex of the first vein. Squamae velvety brown, with white fringe. Halteres brown.

Abdomen shining blue black, each segment with an apical grey pollinose spot which is twice as wide as long. Pile short, black, on the disc; longer, tawny, yellowish and white on the sides. The last two ventral segments bear an apical fringe of long, brownish pile.

♂, Victoria, B. C., March 21, 1921, (R. Glendenning); ♂, Victoria, B. C., May 10, 1916, (R. C. Treherne).

Cyrtopogon Loew

Face gibbose, the swelling reaching the base of the antennae. Third antennal joint usually coarctate, with a basal swelling, narrowest just beyond the base, widest about the middle, rarely but slightly coarctate. Thorax convex, but not strongly so, usually largely pollinose, usually with bristles on lateral margin. Scutellum plain or convex, sometimes wholly or partly pollinose, with or without apical bristles. Legs often more or less specialized with peculiar arrangement of pile; no curved spine on front tibiae. Abdomen tapering in ♂, usually widest in middle of ♀, and rather acute; rarely chiefly pollinose, the segments usually with grey pollinose spots on posterior angles or with entire fasciae, rarely wholly shining. Wings often with faint yellowish clouds on crossveins, sometimes with one or two large, brown spots; third longitudinal vein (R_4 and R_5) branching distinctly beyond the discal crossvein (the vein closing the outer end of the discal cell.) Genotype, *C. ruficornis* Fabr., Europe.

TABLE OF SPECIES.

1. Males	2
Females	20
2. Middle tarsi with a broad pad formed by lateral pile, on the last two or more segments; anterior tarsi with silvery crest above	3
Middle tarsi not with disc like termination, the anterior tarsi not with a crest above	5
3. Anterior tarsi with the crest extending to the base of the basitarsi	<i>praepes</i> Willist.
The crest extends only to the base of the second joint, but there may be a few white hairs on the disc of the basitarsi	4
4. Crest on front tarsi wide, concealed from ventral view by dense black hair; disc of middle tarsi limited to last two joints	<i>callipedilus</i> Loew.
Crest narrower, not much wider than tarsal joints and not concealed from ventral view by black hair; middle tarsal disc not limited to last two joints	<i>willistoni</i> Curr.
5. Wings with one or two large black or brown spots or brownish beyond the middle	6
Wings at most with the crossveins slightly clouded or with pale cinereous or yellowish clouding	9
6. Coxae wholly black pilose; wings brownish beyond the middle, fading out behind and posteriorly; beard wholly black	<i>curtistylus</i> n. sp.
Coxae largely yellow or white pilose	7
7. Wings with a large apical spot and a smaller one covering the apical third of the anal cell	<i>bimaculata</i> Walk.
Wings with only the apical spot or brownish anteriorly beyond the middle	8
8. Mystax wholly black, the hairs stout	<i>dasyllis</i> Willist.
Mystax yellow, some black hairs below	<i>dasylloides</i> Willist.
9. Last joint of front tarsi remarkably elongated and flattened; disc of scutellum almost plane	10
Last joint of fore tarsi normal	11
10. Tibiae wholly black; posterior four tarsi piceous; the front ones reddish	<i>lineotarsus</i> n. sp.
Tibiae and tarsi yellowish, the apex of the front tibiae piceous	<i>leptotarsus</i> n. sp.
11. Trichostical pile practically all, or more than half black	12
Trichostical pile all, or practically all, white	15
12. Abdomen with the terminal segments carinate or subcarinate dorsally, when viewed from behind; abdomen chiefly yellow pilose	13
Abdomen not with the apical segments forming a keel; pile of abdomen almost all black	14
13. Sides of the specialized abdominal segments broadly, very densely, short black pilose; keel not sharp, the middle or keel portion bare and polished except for the narrow transverse pilose fascia; anterior tibiae black pilose	<i>aurifex</i> O. S.

- Sides of keel much more narrowly densely pilose, the keel with quite evident but not abundant appressed hairs pointing towards the apex of keel; anterior tibiae white pilose *albitarsis* Curr.
14. Hind tarsi silvery white pilose above (confer leucozona) .. *inversus* n. sp.
Hind tarsi wholly black haired *montanus* Loew.
15. Disc of scutellum usually plane, usually entirely grey pollinose, but the sides may be black 16
Disc of scutellum convex, not grey pollinose 18
16. Sides of disc of scutellum broadly shining black, the apical margin pollinose *lutatus* Walk.
Sides of disc of scutellum pollinose; whole apical margin shining 17
17. Pile of mesopleura all white; first two abdominal pollinose fasciae normally entire *nugator* O. S.
Pile of mesopleura black, with only a few white hairs below; pollinose abdominal fasciae all interrupted *sansoni* n. sp.
18. Pile of mesopleura pale; third antennal segment red, tibiae all yellowish except their apices; all the tibiae and tarsi white pilose; bristles on fore tarsi short, yellow *marginalis* Loew.
Pile of mesopleura black; third antennal segment black, tibiae only reddish on basal half or less; posterior four tarsi black haired above; bristles on fore tarsi stout, black *falto* Walk.
19. Omitted.
20. Large species; basal abdominal segments evenly yellow pilose, the last two black pilose; elongate *dasyloides* Willist.
Smaller; pile in tufts or not wholly yellow on basal segments 21
21. Scutellum densely grey or yellowish pollinose, usually flat 22
Scutellum not densely grey pollinose, usually convex 26
22. Only middle line of the scutellum pollinose, the apex pollinose *lutatus* Walk.
Scutellum wholly pollinose, the immediate apex shining 23
23. Mystax wholly black 25
Mystax white or yellow on the sides 24
24. Tibiae all reddish or yellow, darker apically *leptotarsus* n. sp.
Tibiae piceous or black *predator* n. sp.
25. First abdominal segment with a posterior greyish pollinose crossband ..
profusus O. S.
First abdominal segment only greyish pollinose on the sides 37
26. Sides of abdomen with conspicuous alternate black and yellow pile
..... *willistoni* Curr.
Sides of abdomen with not conspicuously contrasted pile 27
27. Pile on sides of first three segments long, wholly yellow .. *willistoni* Curr.
Pile usually shorter, or wholly black or yellowish 28
28. Trichostical pile practically all black 29
Trichostical pile almost all white or yellow 33
29. Abdominal crossbands broadly interrupted 30
Abdominal crossbands normally entire 31
30. Third antennal segment red *varans* n. sp.
Third antennal segment black; anterior crossvein near the middle of the discal cell *bimacula* Walk.

31. Sternopleura with fine white hair *leucozona* Loew.
 Sternopleura with fine black hair 32
32. Tibiae often chiefly reddish, the white hair on hind tibiae not abundant; if
 long and appearing silvery the tibiae are reddish *montanus* Loew.
 Tibiae always wholly black; white hair on hind tibiae long, rather dense,
 appearing silvery from basal view *inversus* n. sp.
33. Abdominal crossbands normally entire 38
 Abdominal crossbands interrupted, or third antennal segment red 34
34. Third antennal segment red *marginalis* Loew.
 Third antennal segment black 35
35. Posterior tibiae reddish on basal half *falto* Walker.
 Posterior tibiae more extensively reddish or all black 36
36. Posterior tibiae and tarsi all black; mystax black and yellow sp.
 Posterior tibiae and tarsi chiefly red; mystax black and whitish *plausor* O. S.
callipedillus
37. Pile of mesopleura all black; abdominal bands normally all interrupted....
 *sansoni* n. sp.
 Pile of mesopleura pale, sometimes a few long, black hairs in middle; first
 two abdominal fasciae normally entire *nugator* O. S.
38. All the tibiae rather pale yellow *albitarsis* Curr.
 Front tibiae blackish or piceous *leucozona* Loew

(to be continued) 132

Mailed June 11th, 1923.

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